Teamwork and Clinical Error Reporting among Nurses in Korean Hospitals

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SUMMARY
Purpose: To examine levels of teamwork and its relationships with clinical error reporting among Korean hospital nurses.
Methods: The study employed a cross-sectional survey design. We distributed a questionnaire to 674 nurses in two teaching hospitals in Korea. The questionnaire included items on teamwork and the reporting of clinical errors. We measured teamwork using the Teamwork Perceptions Questionnaire, which has five subscales including team structure, leadership, situation monitoring, mutual support, and communication. Using logistic regression analysis, we determined the relationships between teamwork and error reporting.
Results: The response rate was 85.5%. The mean score of teamwork was 3.5 out of 5. At the subscale level, mutual support was rated highest, while leadership was rated lowest. Of the participating nurses, 522 responded that they had experienced at least one clinical error in the last 6 months. Among those, only 53.0% responded that they always or usually reported clinical errors to their managers and/or the patient safety department. Teamwork was significantly associated with better error reporting. Specifically, nurses with a higher team communication score were more likely to report clinical errors to their managers and the patient safety department (odds ratio = 1.82, 95% confidence intervals [1.05, 3.14]).
Conclusions: Teamwork was rated as moderate and was positively associated with nurses’ error reporting performance. Hospital executives and nurse managers should make substantial efforts to enhance teamwork, which will contribute to encouraging the reporting of errors and improving patient safety.

Introduction
The need for strong teamwork has been emphasized as being necessary for improving quality care, with the increasing complexity of healthcare systems. Healthcare teams vary in terms of team composition and size. Ineffective teamwork has been recognized as a major factor contributing to decreased patient safety [1–3]. Thus, strengthening teamwork worldwide is crucial for enhancing patient safety.

Teamwork refers to a set of interrelated knowledge, skills, and attitudes that team members must possess in order to function as a team [4]. The core components of this concept include leadership, situation monitoring, backup behavior, and communication [4–6]. Previous studies have explored the levels of teamwork by observing team behaviors [7–9] or by using teamwork surveys [10–13]. While observational studies of teamwork are generally resource-intensive, it is frequently difficult to administer instruments to a large number of healthcare providers. Surveys can be used more efficiently to measure teamwork in clinical practice. However, a review of teamwork surveys has found that the conceptualizations of teamwork and psychometric properties varied considerably between instruments [14]. Among the surveys, the Teamwork Perceptions Questionnaire (TPQ) has been recently developed as part of the Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) initiative supported by the Agency for Healthcare Research and Quality, which seems useful in teamwork-related studies in healthcare settings [10,15]. The TPQ captures how healthcare providers perceive the current state of teamwork; teamwork is not affected by prior experience, nor limited to specific departments or specialties [10]. It has broad applicability to various types of teams.
Studies investigating the perceptions of teamwork among healthcare providers showed that the levels of teamwork varied depending on the workplace [16,17]. For instance, nurses working at intensive care units rated teamwork as higher than did those working in medical-surgical units [17]. In addition, there were differences in the dimension levels of teamwork [10,15]. A study of US nurses showed that team leadership had the highest priority for improvement [15]. From this perspective, levels of teamwork may vary by healthcare systems and settings. In addition, diagnosing the current state of teamwork is necessary in order to enhance teamwork in the workplace.

Researchers have proposed that teamwork positively influences staff performance regarding patient safety and patient outcomes [3,18]. For instance, a study of nine emergency departments found that improved teamwork led to a significant decrease in clinical error rates [19]. This reduction of errors and adverse events has also been reported in outpatient oncology [20], labor and delivery [21], and surgery [22]. However, most of the existing research has concentrated on building teamwork and reducing clinical errors in specific workplaces. Other studies focusing on nursing teams, rather than teams including various healthcare professionals, showed that higher levels of nursing teamwork related to lower levels of patient falls leading to injury [23]. Inadequate nursing teamwork was an important predictor for missed nursing care [17]. However, to the best of our knowledge, very few studies explore the relationship of teamwork with error reporting in inpatient care settings.

A clinical error is a preventable adverse event or a near miss within the current medical knowledge context [24]. Clinical errors include both acts of commission and omission [24]. One such error type, the near miss, is an event or situation that though potentially harmful, does not result in any harm to the patient [25]. The magnitude and severity of clinical errors have been reported in many studies [2,26,27]. The factors and conditions associated with error occurrence include individual characteristics (e.g., age, gender, years of nursing experience, and education level) and work environment characteristics (e.g., work unit, working conditions and workload, and hospital environment) [28–33]. Poor teamwork and communication failures have been identified as the most common causes of clinical errors in practice [1,34,35].

Identifying the incidence and nature of clinical errors in real practice is necessary for effective error reduction. Many healthcare institutions have implemented error-reporting systems. Data and information that are built into, and analyzed through clinical error reporting help detect vulnerable processes behind patient safety incidents and provide opportunities that improve system performance and prevent future patient safety risks [36,37]. Clinical error reporting is a crucial component of creating a safer healthcare system. However, the underreporting of clinical errors is a challenge to patient safety improvement. In this regard, we focus on teamwork and error reporting in this study.

Specifically, we aimed to examine the levels of teamwork in Korean hospitals using a reliable, valid teamwork tool. In addition, we investigated the relationships between teamwork and nurses’ error reporting. Identifying the strengths and weaknesses of the current state of teamwork and investigating its relationships with safety-relevant staff performances will help healthcare professionals develop strategies that enhance patient safety.

Methods

Study design

This study employed a cross-sectional survey design. The data reported in this paper were collected as part of a larger study of human and organizational factors relevant to patient safety. The project included explorations of systems thinking and situational awareness, as well as teamwork.

Setting and sample

This study was conducted in two acute-care teaching hospitals in Seoul, Korea. The hospitals have different nurse staffing levels in terms of the ratio of the number of patient beds per nurse: 2.0 to less than 2.5 for one hospital and 2.5 to less than 3.0 for the other hospital. Both hospitals had three nursing shifts of 8 hours. Nurse managers in care units involve in direct patient care. The target population was nurses in adult patient care units, including operating rooms. We excluded psychiatric and ambulatory care departments. The sample consisted of 674 nurses (423 nurses from one hospital and 251 nurses from the other). To evaluate the appropriateness of this sample size, we considered the following recommendations: (a) at least 10 cases per item for factor analyses, (b) ability to obtain a power of 0.80 with a medium effect size ($P^2 = 0.06$) and a significance criterion of .05 in analysis of variance, and (c) 10–20 cases per predictor in logistic regression analysis [38]. The sample size met all these criteria.

Ethical consideration

This study was part of a larger research project on human and organizational factors relevant to patient safety. The overall study protocol was approved by the Institutional Review Boards of the two study hospitals (KHNMC-OH-IRB 2012-011, KOMCIRB-2012-19).

Measurements and instruments

Teamwork was measured using TPQ. The US Agency for Healthcare Research and Quality and the Department of Defense launched a multiyear research and development effort in 2006 to create TeamSTEPPS as the national standard for team training in healthcare. The TeamSTEPPS program has a publicly available toolkit that includes the TPQ [10,39]. This questionnaire has a sound theoretical basis, and its psychometric property has been validated in hospital settings [10,11,39]. The TPQ, which can be applied to various types of healthcare teams, is available in the public domain. It consists of 35 items under the five subscales of team structure, leadership, situation monitoring, mutual support, and communication. Each subscale has seven items. The TPQ was translated to Korean by the first author of the present study. The relevance and validity of the translated scale along with the fluency of the translation were reviewed by two bilingual nursing professors and one researcher in the National Evidence-based Healthcare Collaborating Agency. No adaptations were judged necessary for a Korean hospital setting, although minor description revisions were made. The resulting questionnaire was pilot-tested with 33 nurses for clarity and readability. Additional linguistic revisions were made for clarity on basis of their feedback.

The participants were asked to indicate their degree of agreement with each statement using a 5-point Likert scale ($1 = strongly disagree$, $5 = strongly agree$). The Cronbach’s alpha coefficient of the entire TPQ was .96, and those for the five subscales were .86, .94, .90, .85, and .89, respectively. Item analysis demonstrated that the corrected item-total correlation coefficients ranged from .54 to .68. No items had average correlation coefficients of less than .30 [38].

Principal components analysis yielded five factors with eigenvalues of 1 or greater, together accounting for 64.1% of the total variance. Each factor corresponded with one of the five subscales. Factor 1 was “mutual support”, factor 2 was “team leadership”, factor 3 was “team communication”, factor 4 was “team structure”, and factor 5 was “team coordination.”
and factor 5 was “situation monitoring”. These five factors accounted for 44.0%, 8.6%, 4.4%, 3.8%, and 3.3% of the variance, respectively. All the items had factor loadings greater than .40 [38]. Although there were cross-loaded items onto multiple factors, they were retained based on theoretical framework [10]. In addition, confirmatory factor analysis revealed that the 35-item five-factor model had acceptable fit to the data (comparative fit index = .891, root mean square error of approximation = .067, and standardized root mean square residual = .053). Thus, we retained all the items.

We defined clinical error as a preventable adverse event, or near miss, such as a medication error or a fall [24]. Nurses were asked to indicate whether they had experienced clinical errors in the last 6 months and whether they then reported the errors to their managers or the patient safety department. If the response was that they “always” or “usually” reported their clinical errors, this was regarded as an appropriate performance of error reporting based on the previous research regarding the categorization of positive responses to the frequency of events reported [40]. The other responses (“sometimes”, “rarely”, and “never”) were coded as indicating “inappropriate” performance.

We also collected general information on the participants. The general characteristics of the participants included age, gender, marital status, educational level, years of nursing experience, and job position. The organizational variables of their workplaces included specific clinical department, nurse staffing level, and hospital type. Employment status was not included since all the nurses worked full-time. Since nurse staffing levels were determined at the hospital level, we included only the type of hospital for the analysis.

Data collection and procedure

A questionnaire survey was conducted in November 2012. The questionnaires were distributed with return envelopes to nurses via the nursing departments of the study hospitals. The nurses invited to the survey received a small gift regardless of participation. The cover letter included an explanation of the purpose of this study, the voluntary nature of the participation, and assurances of both participant anonymity and data confidentiality.

Data analysis

Data were analyzed using SAS version 9.2 (SAS Institute, Cary, NC, USA). We summarized the general characteristics of participants using descriptive statistics, and calculated the TPQ and subscale scores by averaging related items. Thus, possible scores ranged from 1.0 to 5.0. A mean score of 3.0 or higher indicates that the teamwork is in an acceptable range [15]. To examine the internal consistency and reliability of the TPQ and its subscales, Cronbach’s alpha coefficients were calculated. In item analysis, the cut-off values of average correlation coefficients were set to less than .30 [38]. Construct validity was examined using principal components analysis and confirmatory factor analysis. Using principal components analysis with varimax rotation, we examined the number of factors with an eigenvalue of 1 or greater and the variance explained by such factors. We ran confirmatory factor analysis to confirm the five-factor structure. The cut-off values were set to comparative fit index > .90, root mean square error of approximation ≤ .08, and standardized root mean square residual ≤ .10 [41].

Student’s t tests and analysis of variance were conducted in order to identify differences in TPQ scores according to participants’ general characteristics and error reporting. These tests are robust for non-normal distribution, especially if the number of cases per group is at least 20 [38]. Post hoc tests were performed using Tukey's studentized range (honest significant difference) test. Logistic regression analysis was performed to determine the relationship between teamwork and error reporting. Odds ratios (OR) and 95% confidence intervals (CI) were examined. A value of p < .05 was considered statistically significant.

Results

General characteristics of participants

Of the 674 nurses, 576 returned completed surveys with a response rate of 85.5%. Among these, 522 (90.6%) reported experiencing at least one clinical error in the previous 6 months. This study used only the responses of those who had had an experience with clinical error in the previous 6 months (n = 522). The general characteristics of participants are shown in Table 1. Most were female (99.0%), and their mean age was 30.9 (SD = 7.6) years. Of the participants, 177 (33.9%) were married, and 294 (56.3%) had a 4-year bachelor’s degree.

The participating nurses had an average of 9.1 (SD = 7.7) years of nursing experience. Most (89.9%) were in a staff position. More nurses (n = 150, 28.7%) reported working in medical care units than in surgical care units (n = 130, 24.9%), traditional medicine care units (n = 69, 13.2%), operating rooms (n = 76, 14.6%), or intensive care units (n = 97, 18.6%).

Levels of teamwork

The mean score on the entire TPQ was 3.5 (SD = 0.5). Four hundred sixty-three nurses (88.7%) rated teamwork with a mean score of 3.0 or higher. There were significant differences in TPQ scores according to participants’ ages (F = 7.52, p = .001), job positions (t = 3.91, p < .001), and the clinical departments in which they worked (F = 6.96, p < .001). Specifically, nurses aged 40 years or older rated their teamwork higher than did the others. The TPQ scores of the nurse managers were higher than those of the staff nurses. Nurses working in operating rooms rated their teamwork as lower than did the others (Table 1).

At the subscale level, the mean score was 3.4 (SD = 0.5) for team structure, 3.3 (SD = 0.7) for team leadership, 3.5 (SD = 0.5) for situation monitoring, 3.6 (SD = 0.5) for mutual support, and 3.5 (SD = 0.5) for team communication (Table 2). The proportion of nurses who rated their teamwork with a mean of 3.0 or higher was 85.8% (n = 448) for team structure, 78.4% (n = 409) for team leadership, 90.4% (n = 472) for situation monitoring, 92.0% (n = 480) for mutual support, and 93.1% (n = 486) for team communication.

At the item level, the top five items with the highest scores were “staff assist colleagues during high workload,” “staff request assistance from colleagues when they feel overwhelmed,” “staff are held accountable for their actions,” “staff caution each other about potentially dangerous situations,” and “staff explain information regarding patient care to patients and their family in lay terms.” The five items with the lowest scores included “my manager resolves conflict successfully,” “my manager takes time to meet with staff to develop a plan for patient care,” “my unit operates at a high level of efficiency,” “staff meet to re-evaluate patient care goals when aspects of situations have changed,” and “staff advocate for patients even when their opinion conflicts with that of a senior member of the unit.”

Relationship between teamwork and clinical error reporting

Of the 522 nurses who experienced clinical errors, 277 (53.0%) responded that they had always or usually reported clinical errors...
Inappropriate performance was coded as “always,” “usually,” or “sometimes,” while appropriate performance was coded as “never,” “rarely,” or “almost never.” Teamwork was defined as responses of “always” or “usually” on reporting errors, according to previous research findings. The category of appropriate performance was coded as “category of appropriate performance of error reporting.”

Nurses who had appropriately reported clinical errors had a higher teamwork score and in the subscale scores by error reporting (Table 3). This study also shows differences in the teamwork perceptions by nurses’ characteristics. Nurses aged 40 years or older and those in managerial positions have more positive perceptions of teamwork than do the others. This may result from a better understanding of the complicated work processes involving various professionals and departments and the ways they work in teams over time. Another possible explanation is that the accumulated experience and job rank of these veteran nurses made them understand the importance of teamwork. Hence, younger staff nurses can be a priority group for teamwork training programs as part of their in-service education efforts for effective team building and functioning.

In this study, the level of teamwork is rated as moderate. The scores of the TPQ and its subscales are slightly lower than those of other studies [10,11]. This finding may be attributable to the lack of substantial efforts for effective teamwork in most Korean hospitals, although the importance of teamwork has been widely recognized. Therefore, hospital executives and managers need to incorporate teamwork training programs as part of their in-service education efforts for effective team building and functioning.

The score on team leadership is rated the lowest among the five components of teamwork. This is consistent with the previous findings for the US nurses [15]. The role of team leaders is critical in facilitating collaboration and coordination in team functioning. In particular, nurses indicate a lack of involvement of their team leaders in the planning and discussing of patient care and in constructively managing conflicts. Therefore, leadership development strategies and education for team leaders are emphasized as necessary components of better teamwork.

This study also shows differences in the teamwork perceptions by nurses’ characteristics. Nurses aged 40 years or older and those in managerial positions have more positive perceptions of teamwork than do the others. This may result from a better understanding of the complicated work processes involving various professionals and departments and the ways they work in teams over time. Another possible explanation is that the accumulated experience and job rank of these veteran nurses made them understand the importance of teamwork. Hence, younger staff nurses can be a priority group for teamwork training. Furthermore, levels of teamwork varied across clinical departments (Table 1). This is consistent with the previous finding that levels of teamwork are different in different workplaces and settings [16,17]. For instance, while a study of US nurses showed that teamwork in intensive care units was rated as being the highest...
Improved teamwork is positively linked to error reporting. Team communication is the only significant factor associated with the appropriate performance of error reporting. This finding supports the importance of communication for enhancing patient safety [13]. Error reporting is generally a formal, upward communication. Better communication among team members promotes open, all-channeled communication; thus, it will facilitate communication even of clinical errors and patient safety concerns.

Overall, the findings of this study indicate the necessity of improving teamwork. To this end, substantial efforts should be made to focus on the low-ranked items, such as resolving conflicts and having meetings for developing patient care plans, based on the findings of this study. Frontline managers as team leaders in...
inpatient care teams need to spend more time in staff meetings listening to nurses’ concerns about patient care. They should coordinate and support the activities of the staff, and constructively manage possible team conflicts. In addition, hospital executives can provide and support leadership-training programs to facilitate effective team leadership. Generic comprehensive team training, task-specific team training, and quality improvement interventions can be designed in order to improve teamwork [45]. The best example of generic comprehensive team training is the Team-STEPPS program, which is applicable to most providers and care sites, rather than specific healthcare tasks or activities [45]. To improve multidisciplinary teamwork, the aforementioned clinical pathway approach can also be useful [43,44]. Improved teamwork will create a more positive work environment for error reporting. Specifically, closed-loop communication needs to be incorporated to ensure safe team communication. In this type of information exchange, the receiver acknowledges the message by check-back, and the sender verifies that the intended message was received [44,46]. The use of standardized methods of timely information sharing and a common terminology may lead to improved closed-loop communication among team members, which will encourage error reporting.

This study has several limitations. First, it was conducted with only nurses in two teaching hospitals. Therefore, the generalizability of the findings is limited. Second, we measured nurses’ error reporting by using self-administered questionnaire items because we had difficulty obtaining formal reporting documents; thus, recall bias is possible. Third, since this study was cross-sectional in nature, causal relationships cannot be inferred. Thus, we suggest that longitudinal studies, with nurses in different care settings, be conducted to investigate whether improved teamwork through interventions such as team training leads to better patient safety performance. In addition, this study did not include examinations of patient acuity or organizational culture that can contribute to teamwork and error occurrences. Although we included information on hospital type and clinical department in the analysis, further studies will need to include these work environment factors for a better understanding of the dynamics of teamwork and clinical error reporting. Furthermore, this study was conducted in an inpatient care setting with teams that had relatively stable roles as full-time nursing staff members. Future studies should include various healthcare professionals and consider different types of teams consisting of variable roles and personnel make up. On the other hand, this study’s focus on teamwork and error reporting has the following implications: It is apparent that the weaknesses and strengths of teamwork in the current practice will provide a fundamental basis for better teamwork and higher-quality care. Furthermore, evidence concerning the relationship between teamwork and error reporting provide a practical strategy for reducing clinical errors and improving patient safety.

Conclusion

Teamwork is a core element of highly reliable organizations [6]. The findings of this study of acute care hospital nurses indicate the need to improve teamwork by focusing on team leadership. Therefore, hospital executives and nurse managers should monitor both overall teamwork and subscale scores and identify areas requiring improvement. The teamwork scale validated in this study can be used as a reliable, economical tool. Furthermore, we also recommend a tailored approach considering the five components of teamwork to create interventions that effectively improve teamwork.

Our results provide evidence that teamwork is related to the safety-relevant performance of error reporting. In particular, team communication is an important factor associated with error reporting. Therefore, in an inpatient setting, a series of efforts to enhance teamwork and communication facilitates learning from clinical errors, thereby contributing to improved patient safety.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgment

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References


Table 4 Logistic Regression Analysis for Appropriate Error Reporting (N = 522).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>Gender(=female)</td>
<td>1.79 (0.26–12.17)</td>
<td>1.89 (0.27–13.14)</td>
</tr>
<tr>
<td>Age &lt;29</td>
<td>1.35 (0.56–3.23)</td>
<td>1.29 (0.54–3.11)</td>
</tr>
<tr>
<td>30–39</td>
<td>0.61 (0.28–1.30)</td>
<td>0.58 (0.27–1.25)</td>
</tr>
<tr>
<td>40+</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Marital status(=married)</td>
<td>1.24 (0.76–2.04)</td>
<td>1.26 (0.77–2.07)</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-year university</td>
<td>1.17 (0.75–1.81)</td>
<td>1.17 (0.76–1.83)</td>
</tr>
<tr>
<td>Graduate school or higher</td>
<td>2.04 (1.06–3.92)</td>
<td>1.93 (0.99–3.73)</td>
</tr>
<tr>
<td>3-year college</td>
<td>Reference</td>
<td>Reference</td>
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<tr>
<td>Years of nursing experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 years</td>
<td>0.90 (0.48–1.71)</td>
<td>0.89 (0.47–1.70)</td>
</tr>
<tr>
<td>3 to less than 5 years</td>
<td>0.64 (0.28–1.47)</td>
<td>0.66 (0.29–1.53)</td>
</tr>
<tr>
<td>5 to less than 10 years</td>
<td>0.78 (0.41–1.47)</td>
<td>0.77 (0.41–1.46)</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>Reference</td>
<td>Reference</td>
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<tr>
<td>Clinical department</td>
<td></td>
<td></td>
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<tr>
<td>Medical care unit</td>
<td>1.67 (1.02–2.73)</td>
<td>1.68 (1.03–2.76)</td>
</tr>
<tr>
<td>Traditional medicine care unit</td>
<td>1.45 (0.79–2.67)</td>
<td>1.41 (0.76–2.61)</td>
</tr>
<tr>
<td>Operating room</td>
<td>1.70 (0.93–3.12)</td>
<td>1.81 (0.98–3.36)</td>
</tr>
<tr>
<td>Intensive care unit</td>
<td>1.56 (0.90–2.71)</td>
<td>1.50 (0.85–2.64)</td>
</tr>
<tr>
<td>Surgical care unit</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Hospital (=A)</td>
<td>0.78 (0.53–1.16)</td>
<td>0.79 (0.53–1.18)</td>
</tr>
<tr>
<td>Job position (=staff)</td>
<td>1.58 (0.71–3.55)</td>
<td>1.54 (0.69–3.48)</td>
</tr>
<tr>
<td>Overall teamwork</td>
<td>2.12 (1.39–3.23)</td>
<td>2.07 (1.36–3.14)</td>
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<tr>
<td>Team structure</td>
<td>0.92 (0.50–1.69)</td>
<td>1.02 (0.55–1.89)</td>
</tr>
<tr>
<td>Team leadership</td>
<td>1.13 (0.78–1.62)</td>
<td>1.16 (0.79–1.67)</td>
</tr>
<tr>
<td>Situation monitoring</td>
<td>0.96 (0.52–1.78)</td>
<td>0.98 (0.52–1.79)</td>
</tr>
<tr>
<td>Mutual support</td>
<td>1.23 (0.66–2.30)</td>
<td>1.25 (0.67–2.35)</td>
</tr>
<tr>
<td>Communication</td>
<td>1.82 (1.05–3.14)</td>
<td>1.93 (1.14–3.26)</td>
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Note. CI = Confidence interval; OR = Odds ratio.
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